

# Displacement, Velocity and Acceleration

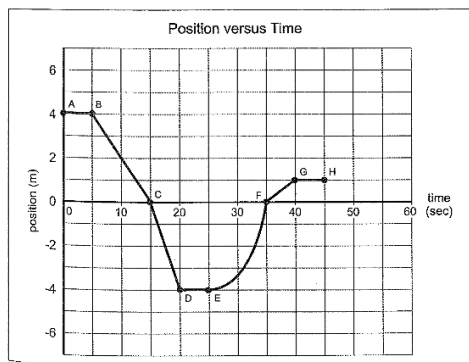
## Position-Time Graphs

Position is represented on a position-time graph, which looks very much like a distance-time graph. However, do not forget that position is a vector and will have a direction.

The slope of a position-time graph gives you the velocity of the motion.

The slope of a tangent at a point on a position-time graph gives the instantaneous velocity.

Ex.

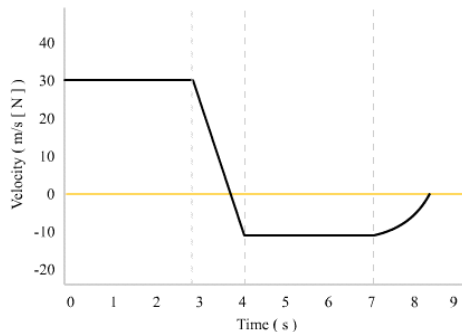


- a) What is happening from A to B?
- b) What is happening from B to C?
- c) What is happening from C to D?
- d) What is happening at E to F?
- e) Calculate the velocity from B to C.
- f) Find the velocity at 32 s.

## Velocity-Time Graphs

On a velocity-time graph, acceleration is given by the slope.

Ex.



What is happening from 0 – 3s?

Describe the motion from 3s to 4s.

Describe the motion from 4s to 7s.

What is happening from 7s to 8.5s?

What is the acceleration from 3s to 4s?

Average velocity is given by the formula we have already seen, but can also be given by:

$$\vec{v}_{av} = \frac{\vec{v}_1 + \vec{v}_2}{2}$$

Ex. Slartbartifast the Third runs into a wall while taking himself for a walk. What is his average velocity if the initial velocity is 7.4 m/s [S27°W] and he comes to rest 0.17s later? Assume constant acceleration.

## Acceleration and Velocity

Acceleration and velocity are also vector quantities. Our equations are very similar to before:

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

Remember, in your final answer, you must get rid of the positive or negative sign and write in the direction.

Ex. A train slows down from 50.0 m/s [E] to 34.0 m/s [E] in 4.0 s. What is its acceleration?

Ex. Johnny throws a ball straight up from the ground. The ball leaves his hand with an initial velocity of 12.0 m/s. The acceleration of the ball is  $9.81 \text{ m/s}^2$  [down].

a) What is the velocity of the ball after 0.50s?

b) What is the velocity of the ball after 1.8 s?

Handy table to think about:

Velocity Direction	Acceleration Direction	Size of Velocity (Speed)
+	+	
-	-	
+	-	
-	+	